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NASA TECH BRIEF

NASA Pasadena Office

Stable Group Delay Cable

The problem:

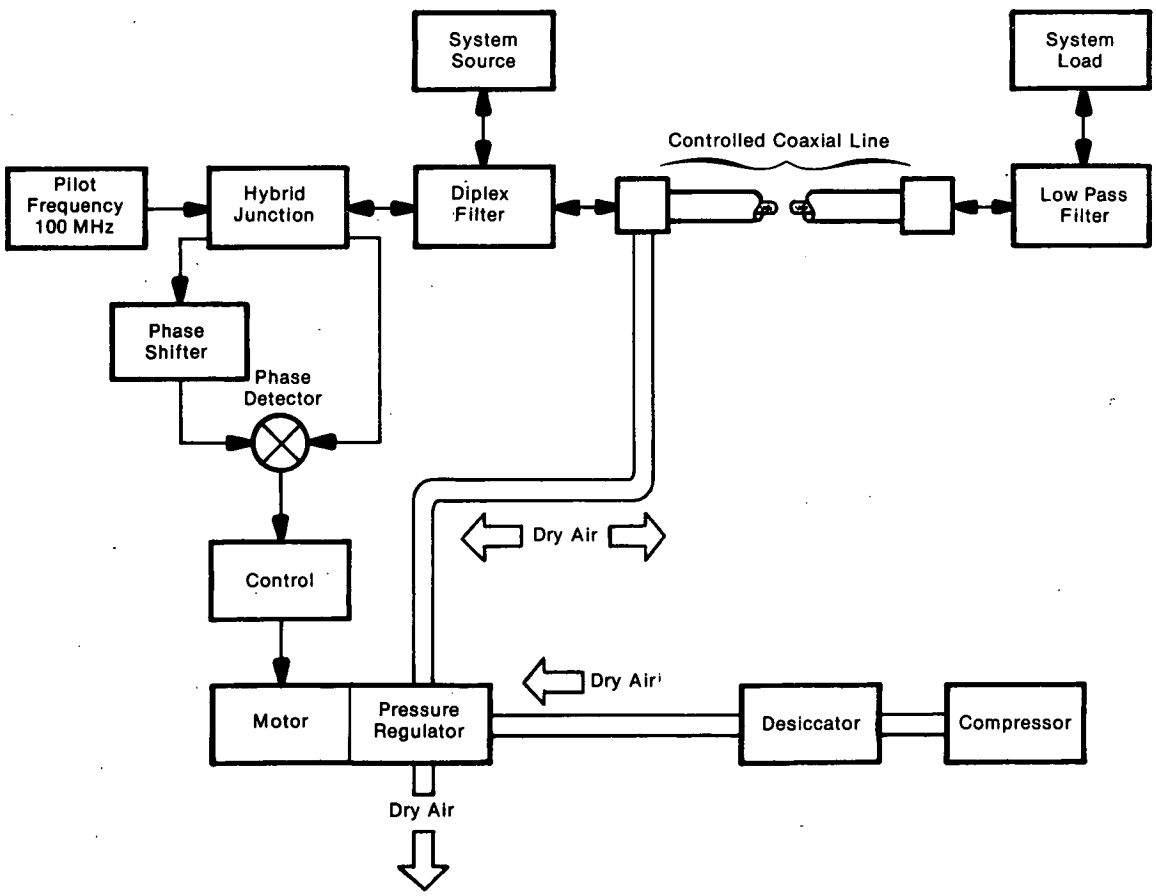
In distributing precision time and frequency standard signals from a control station to widely-separated user stations, variable phase delays can exist along the distribution cables because of temperature variations and other physical influences. When the lines are long, these delays degrade the timing accuracy available from high precision standards, such as the hydrogen maser frequency standard.

The solution:

It was found that group delay is a function of pressure in an air dielectric coaxial cable. For example, a 600-ft (183-m) air dielectric cable will change phase 10° at 150 MHz when the air pressure in the cable changes from zero to 20 lb/in.^{2} (1.4×10^5 N/m^2).

How it's done:

The figure is a block diagram of the operational controls of the system. A pilot frequency generator



Block Diagram of Stable Group Delay Cable

(continued overleaf)

sends a 100-MHz signal through the controlled coaxial line via a hybrid junction and a diplex filter. Since the coaxial line is terminated in a low pass filter, any reflection of the 100-MHz signal due to line pressure variation shows up as a phase shift in the phase detector. The phase shifter is adjusted to operate the phase detector near zero volts. The phase detector compares the phase of the 100-MHz pilot and the reflected 100 MHz from the coaxial line. An output indicates a change in the electrical length of the coaxial line.

The phase detector dc output actuates a displacement servo comprising a proportional control and a motor drive. Attached to the motor is a pressure regulator which meters the flow of dry pressurized air to the coaxial line in order to maintain a constant pressure. The motor regulator being used can produce phase shifts which correspond to changes in electrical length over a dynamic range of 8 to 12 cm per 500 ft (152.5 m) of cable. Additionally, it enables pressure regulation by venting excess coaxial line pressure to the atmosphere.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP74-10295

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,790,906). Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
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Categories: 01 (Electronics - Components and Circuitry)
05 (Life Sciences)